5.0 COLLISION TYPES

A breakdown of collision data according to the more frequent accident types is provided in this section. Factors influencing the frequency of collisions and methods used to reduce the number of collisions are also discussed.

While the discussion in this section focuses on the influence of roadway design, it is important to realize that human and vehicular factors have a great deal of influence on the frequency and severity of collisions. Such factors include driver ability and attention, sobriety, vehicle speed, and vehicle condition. While characteristics such as roadway geometry or congestion may be contributing factors, collisions usually involve either an error in driver judgment or an equipment failure.

Figure 7 shows a breakdown of 2003 collisions by the type of accident. Approximately two-thirds of the accidents fall into one of three categories: run-off-road, rear end, and right angle collisions. Pedestrian and bicycle accidents comprise 1.4% and 1.0% of the accidents, respectively. While these two collision types are less frequent, they receive special attention due to their severity.

Figure 7
2003 Collisions by Accident Type

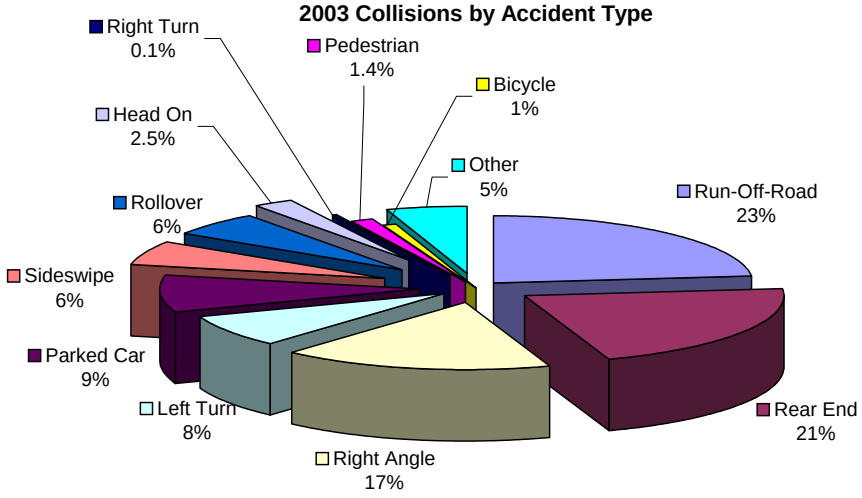
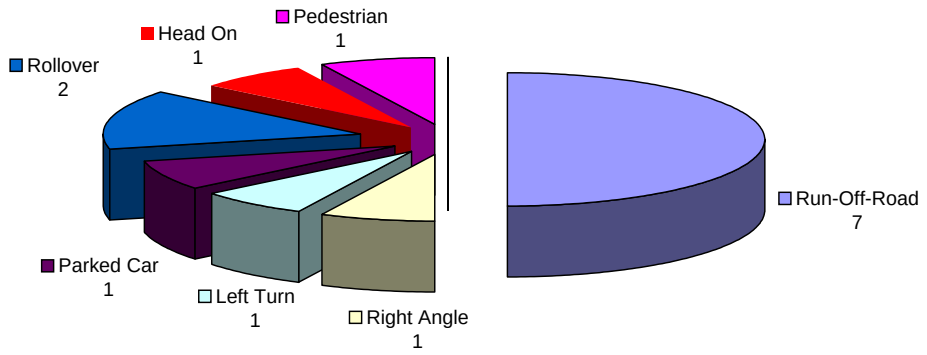


Figure 8 is a breakdown of fatal collisions by accident type. It should be noted that while run-off-road collisions made up approximately one-fourth of the total accidents, they accounted for one-half of the fatal accidents. While this would not be considered statistically significant over a one-year time frame due to the relatively small number of fatal accidents (14 in 2003), review of collision data for the last ten years indicates a nearly identical pattern. Nationwide, approximately one-third of fatal collisions are run-off-road accidents.[5]

Figure 8
2003 Fatal Collisions by Accident Type



A breakdown of collisions by severity and accident type for 2002 and 2003 is provided in Table C1 (Appendix C). This table also includes the estimated societal cost according to type of collision. The following subsections discuss some of the more frequent collision types.

5.1.

[5] NCHRP Report 500, Volume 6: "A Guide for Addressing Run-Off-Road Collisions"

Run-Off-Road Collisions

5.1.1. Definition

A run-off-road collision is defined as an event where a vehicle leaves the traveled portion of the roadway, and is unable to recover prior to encountering an object, body of water, or embankment (ditch). A large number of run-off-road collisions go unreported when the vehicle is able to return to the roadway and drive away after the collision. These tend to be minor collisions but can exceed the $500 reporting threshold, particularly when roadside objects such as guardrail, fire hydrants, and poles are damaged.

Features such as horizontal and vertical curves, narrow roadways, varying shoulder widths, roadside obstacles, and steep embankments tend to increase the frequency of run-off-road collisions. Roadway reconstruction, shoulder widening, and removal of obstacles can reduce the number and severity of run-off-road collisions. Installation of guardrail and other traffic barriers can reduce the severity of these collisions. However, installing barriers may result in a slight increase in the number of collisions since barriers are usually closer to the roadway than the hazards they are shielding.

5.1.2. 2003 Collision Experience

As previously noted, approximately one-fourth of the vehicular collisions in unincorporated King County were run-off-road collisions, making this the most frequent accident type. Seven of the fourteen fatal accidents that occurred in 2003 were run-off-road collisions.

A total of 629 run-off-road collisions occurred during 2003, with an estimated cost of $22.1 million. A breakdown of these collisions according to severity is shown in Figure 9. Two-thirds of the collisions were PDO accidents.

Figure 9
2003 Run-Off-Road Collisions by Severity

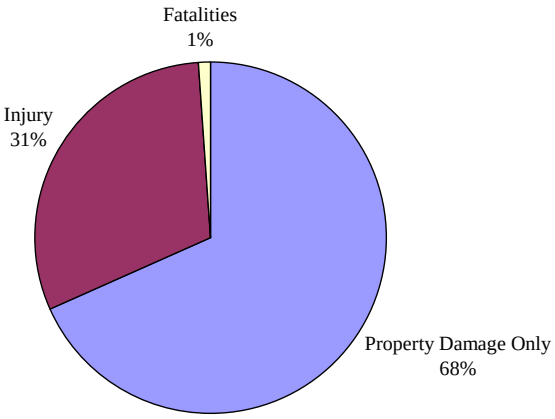
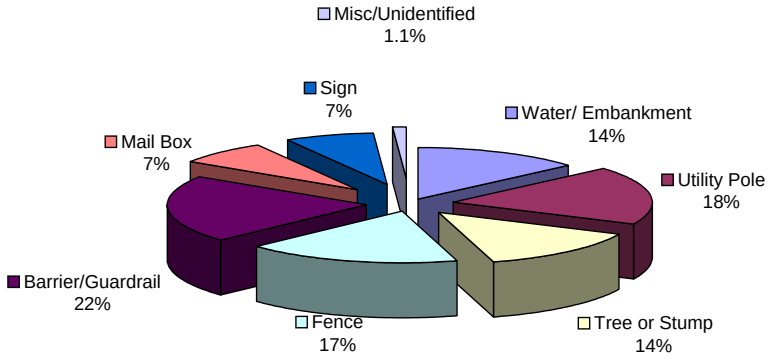


Figure 10 shows a breakdown of run-off-road collisions by the type of object struck. Several objects can be struck during a single collision, and this breakdown refers to the first object encountered according to the Officer's report.

Figure 10
2003 Run-Off Road Collisions by Object Struck



As shown in Figure 10, guardrail and other traffic barriers were the most frequently struck object, comprising nearly one-fourth of the run-off-road collisions. Isolated fixed objects (utility poles, fences, trees, signs and mailboxes) were involved in nearly two-thirds of the run-off-road collisions. Utility poles were the mostly frequently struck isolated fixed objects.

A breakdown of run-off-road collisions by severity and object struck for 2002 and 2003 is provided in Table C2 (Appendix C).

5.2.

Rear-End Collisions

5.2.1. Definition

A rear-end collision occurs when one vehicle runs into the rear of another vehicle that is traveling in the same direction. This accident type does not include collisions with parked cars. In almost all cases, fault is assigned to the driver of the rear vehicle.

Rear-end collisions frequently occur when a vehicle suddenly overtakes another vehicle that has slowed or stopped unexpectedly. The front vehicle may slow or stop at traffic lights or stop signs, prior to turning, when overtaking queues caused by traffic congestion, or in response to emergency situations. Traffic congestion and limited sight distance can increase the number of rear-end collisions.

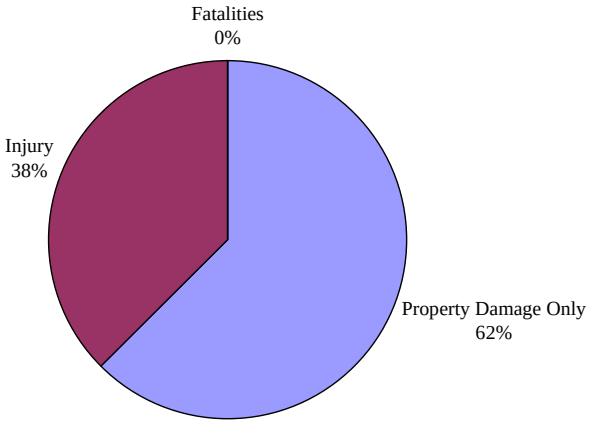
The number of rear-end collisions can frequently be reduced by adding turn lanes, reducing congestion, or improving sight distance. Sight distance improvements include trimming trees, removing visual obstructions, and reconstruction of roadways to reduce horizontal and vertical curvature.

5.2.2. 2003 Collision Experience

As previously noted, nearly one-fourth of the vehicular accidents in unincorporated King County were rear end collisions, making this the second most frequent accident type. A total of 577 rear end collisions occurred during 2003, with an estimated cost of $16.3 million.

A breakdown of these collisions according to severity is shown in Figure 11.

Figure 11
2003 Rear End Collisions by Severity



5.3. Right Angle Collisions

5.3.1. Definition

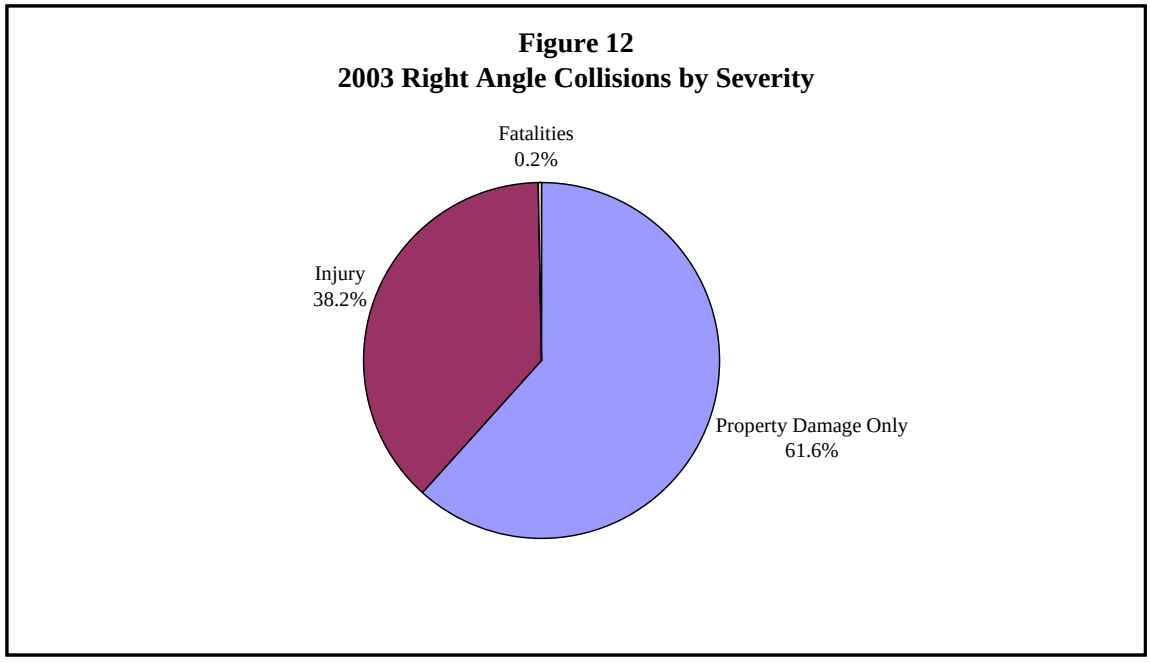
A right angle collision is defined as a collision where one vehicle enters a roadway and is struck by a second vehicle at an angle of approximately 90 degrees. The entering vehicle may be entering from a driveway or another street, and may be attempting to cross the street or turning right. A right angle collision occurs because one of the vehicles fails to yield the right-of-way, whether assigned by a traffic signal, yield or stop sign, or by state law (in the case of driveways and unsigned intersections).

Right angle collisions occur most frequently at locations where driveways or minor streets intersect higher volume streets, particularly where traffic congestion or limited sight distance is present. Engineering solutions include traffic controls such as four-way stop control, signals, and roundabouts, and sight distance improvements. Driveway collisions can usually be reduced by access control measures such as closing or relocating driveways, or prohibiting movements such as left turns. All of these solutions can have undesirable side effects, including increases in other types of accidents. For this reason these improvements need to be carefully evaluated prior to implementation to ensure that the benefits outweigh the limitations.

5.3.2. 2003 Collision Experience

Right angle collisions were the third most frequent type of accident, comprising 17% of accidents during 2003. A total of 456 right angle collisions occurred, with an estimated cost of $14.0 million. A breakdown of these collisions according to severity is shown in Figure 12.

Figure 12
2003 Right Angle Collisions by Severity



5.4. Left Turn Collisions

5.4.1. Definition

A left turn collision occurs when one vehicle attempting to make a left turn collides with another vehicle traveling in the opposite direction. State law requires the left turning vehicle to yield to oncoming traffic unless a sign or traffic signal indicates otherwise.

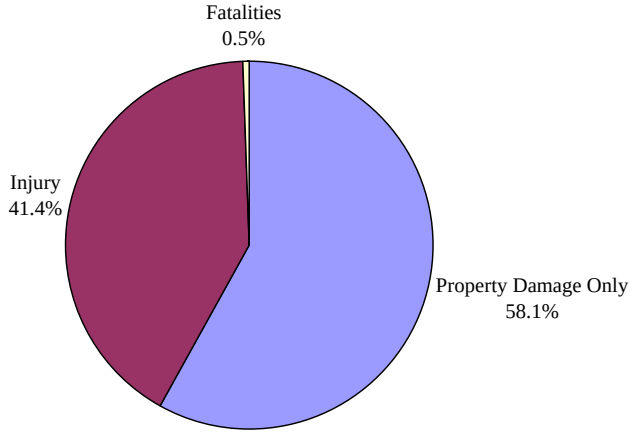
The number of left turn collisions may be higher at locations with high traffic volumes, congestion, or limited sight distance. Improvements such as left turn lanes and left turn signal phasing[6] are frequently used to reduce the number of left turn collisions.

5.4.2. 2003 Collision Experience

Eight percent of the accidents during 2003 were left turn collisions. A total of 210 left turn collisions occurred, with an estimated cost of $7.4 million.

A breakdown of these collisions according to severity is shown in Figure 13.

Figure 13
2003 Left Turn Collisions by Severity



[6] Left turn signal phasing uses a "green arrow" signal head and provides a "protected" movement for left turning vehicles

5.5. Parked Car Collisions

5.5.1. Definition

Parked car collisions occur when a vehicle leaves the road and collides with a vehicle outside of the traveled portion of the roadway. The parked vehicle can be occupied and running, but cannot be moving. This collision type does not include accidents that occur in parking lots or other privately owned areas unless the parked vehicle is located adjacent to a roadway and is struck by a vehicle that departed from the roadway immediately prior to the collision. This collision type also excludes accidents with vehicles stopped in travel lanes (e.g. vehicles stopped at a signal or while waiting to turn).

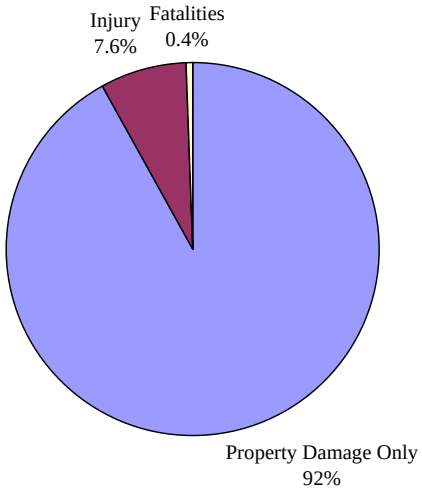
This type of collision occurs most frequently on roadways with on-street parking. Factors that can increase the number of parked car collisions include limited sight distance, high speeds and volumes, retail land use, and wide roadways with no lane designation. Improvements to reduce the number of parked car collisions include parking prohibitions, adding striping to differentiate between travel and parking lanes, and increasing the width of parking areas.

5.5.2. 2003 Collision Experience

Nine percent of the accidents during 2003 were parked car collisions. A total of 236 parked car collisions occurred, with an estimated cost of $3.5 million.

A breakdown of these collisions according to severity is shown in Figure 14. As indicated in this figure, over 90% of parked car collisions in 2003 were property damage only.

Figure 14
2003 Parked Car Collisions by Severity



5.6. Sideswipes

5.6.1. Definition

A sideswipe is defined as a shallow-angle collision. Typically the vehicles are traveling on the same roadway, and can be moving in the same or opposite directions.

Same direction sideswipes frequently occur in areas where lane changes, merging or sudden stops are required. These collisions can frequently be reduced using the same approaches as for rear-end accidents.

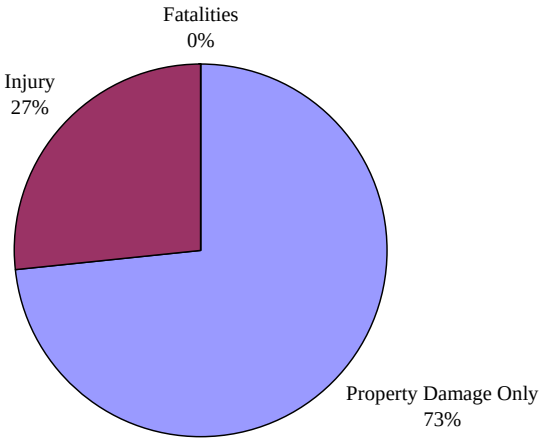
Features such as horizontal and vertical curves, narrow roadways, varying lane widths, and merging zones tend to increase the frequency of opposite direction sideswipes. Typical improvements include roadway reconstruction and centerline treatments such as rumble strips, medians, and islands.

5.6.2. 2003 Collision Experience

Six percent of the accidents during 2003 were sideswipes. A total of 157 sideswipes occurred, with an estimated cost of $3.4 million.

A breakdown of these collisions according to severity is shown in Figure 15. As indicated, nearly three-fourths of sideswipes in 2003 were PDO accidents.

Figure 15
2003 Sideswipe Collisions by Severity



5.7. Head-On Collisions

5.7.1. Definition

A head-on collision occurs when two vehicles traveling in opposite directions collide at little or no angle.

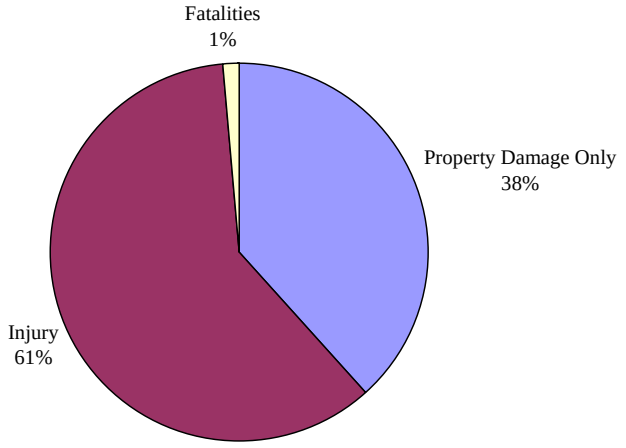
As with opposite direction sideswipes, features such as horizontal and vertical curves, narrow roadways, varying lane widths, and merging zones tend to increase the frequency of head-on collisions. Typical improvements include roadway reconstruction and centerline treatments such as rumble strips, medians, and islands.

5.7.2. 2003 Collision Experience

Three percent of the accidents during 2003 were head-on collisions. A total of 68 collisions occurred, with an estimated cost of $3.8 million.

A breakdown of these collisions according to severity is shown in Figure 16. As indicated by this figure, head-on collisions tend to be more severe than most other accident types.

Figure 16
2003 Head-on Collisions by Severity



5.8.

Pedestrian Collisions

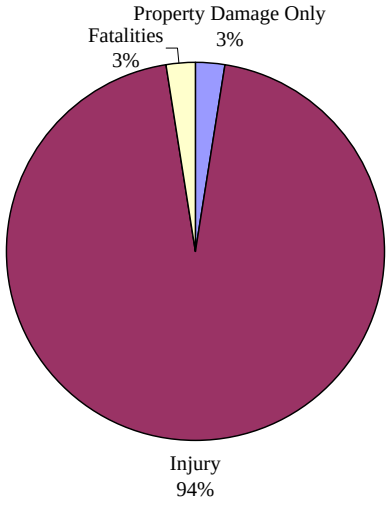
Reported pedestrian collisions are infrequent, but receive special attention due to their severity. Pedestrian collisions that do not result in injuries are rarely reported, and therefore the frequency of these accidents is not known.

A number of approaches are utilized with the intention of reducing the number of pedestrian collisions. These approaches include physical improvements such as pathways, sidewalks, and enhanced crosswalks; and other actions such as providing crossing guards at schools, education, and enforcement of jaywalking and speed limit laws. Due to the infrequent nature of these collisions, it is difficult to assess the impact of improvements at specific locations unless large numbers of pedestrian collisions have occurred.

5.8.1. 2003 Collision Experience

Pedestrian collisions comprised 1.4% of the accidents during 2003. A total of 39 collisions occurred, with an estimated cost of $3.4 million. A breakdown of pedestrian collisions according to severity is shown in Figure 17.

Figure 17
2003 Pedestrian Collisions by Severity



An area of significant concern is the age of pedestrian involved in collisions. Figure 18 provides a breakdown according to the age for 2003 collisions. Due to the relatively low number of pedestrian collisions during a given year, it is useful to look at a longer time period. Figure 19 provides the same breakdown for collisions over the last 10 years.

Figure 18
2003 Pedestrian Collisions by Age

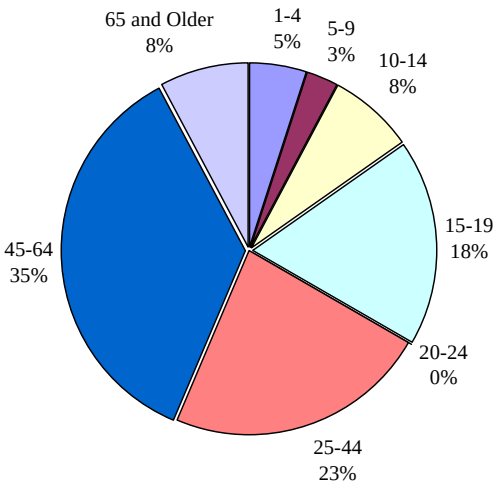
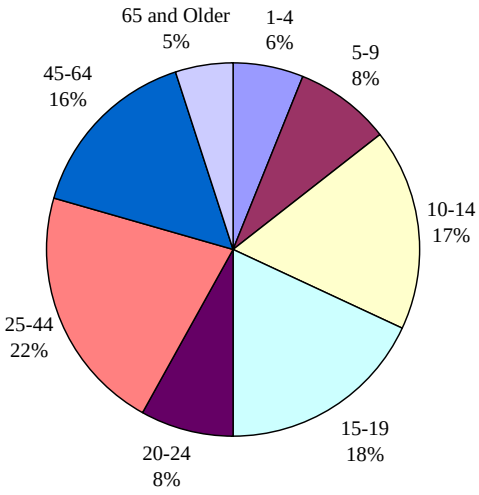


Figure 19
1994-2003 Pedestrian Collisions by Age



As indicated in Figure 19, approximately one-half of the collisions in the past 10 years involved pedestrians under age 20. This may be an appropriate area for additional focus with respect to safety efforts.

The data was also reviewed for pedestrian collisions within school zones. No pedestrian collisions took place in school zones during 2003. Over the past ten years, there have been three collisions within school zones that involved pedestrians.

The pedestrian action and priority of pedestrian collisions over the last 10 years are summarized in Table 3. Priority refers to whether the pedestrian or vehicle had the right of way at the time of collision.

TABLE 3
PEDESTRIAN COLLISIONS BY ACTION AND PRIORITY
(1994-2003 TOTALS)

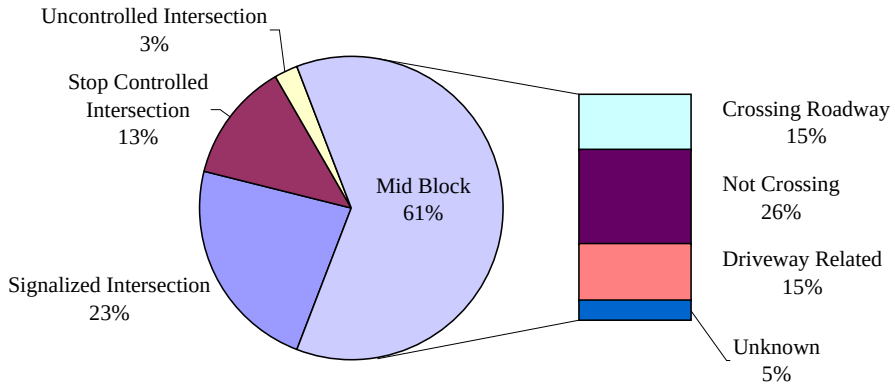
Action	Priority	Total Number	Percentage
Crossing at Intersection	Priority Given to Pedestrian	148	31%
Crossing at Intersection	Priority Given to Vehicles	26	5%
Crossing, Non-Intersection	Priority Given to Pedestrian	0	0%
Crossing, Non-Intersection	Priority Given to Vehicles	114	24%
Walking on Roadway Shoulder	Priority Given to Pedestrian	43	9%
Walking on Roadway No Shoulder	Priority Given to Pedestrian	31	7%
Walking or Standing In Roadway	Priority Given to Vehicles	43	9%
Other		70	15%
Total		**475**	**100%**

As indicated in this table, 60% of pedestrian collisions occurred while the pedestrian was crossing the road. Thirty-six percent of the collisions occurred at intersections, while 24% occurred when a pedestrian was crossing at a non-intersection location. In collisions where the priority was determined, pedestrians had the priority in 55% of the time.

Figure 20 provides a breakdown of 2003 pedestrian collisions by location. Nearly two-thirds of the collisions occurred at mid block (non-intersection) locations. The mid block locations are further broken down into pedestrians crossing the roadway (15%), not crossing the roadway (standing in or near the road, 26%) and driveway related collisions (15%). Review of collision reports indicates that two of the 39 pedestrian collisions occurred after motorists or passengers left their vehicle due to an accident or breakdown.

39% of the collisions occurred at intersections. Of these, 60% were located at signalized intersections, 30% occurred at stop controlled intersections, and the remainder took place at uncontrolled intersections.

Figure 20
2003 Pedestrian Collisions by Location



Note: Uncontrolled intersection refers to an intersection where no controls such as stop signs, yield signs, or traffic signals are present. At such intersections, state law requires motorists to yield to any vehicles on their right.

Tables C4 through C6 (Appendix C) provide additional information on pedestrian collisions.

5.9.

Bicycle Collisions

As with pedestrian collisions, bicycle collisions are infrequent, but receive special attention due to their severity.

5.9.1. Definition

The bicycle collision category includes all collisions with human-powered wheeled vehicles, and for this reason the category is sometimes referred to as "pedalcycle" collisions.

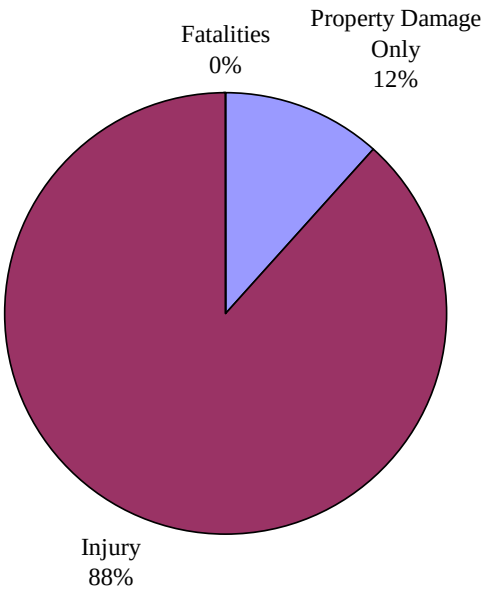
A number of approaches are utilized with the intention of reducing the number of bicycle collisions. These approaches include physical improvements such as wider shoulders, bike lanes, and separated pathways; and other actions such as education and enforcement. Due to the infrequent nature of these collisions, it is difficult to assess the impact of improvements at specific locations.

5.9.2. 2003 Collision Experience

Bicycle collisions comprised 1.0% of the accidents during 2003. A total of 26 collisions occurred, with an estimated cost of $1.5 million.

A breakdown of bicycle collisions according to severity is shown in Figure 21.

Figure 21
2003 Bicycle Collisions by Severity



As with pedestrian collisions, the age of the cyclist is an area of concern. Figures 22 and 23 provide a breakdown according to the age for collisions in 2003 and over the past ten years. Table C7 (Appendix C) provides this information in tabular form.

Figure 22
2003 Bicycle Collisions by Age

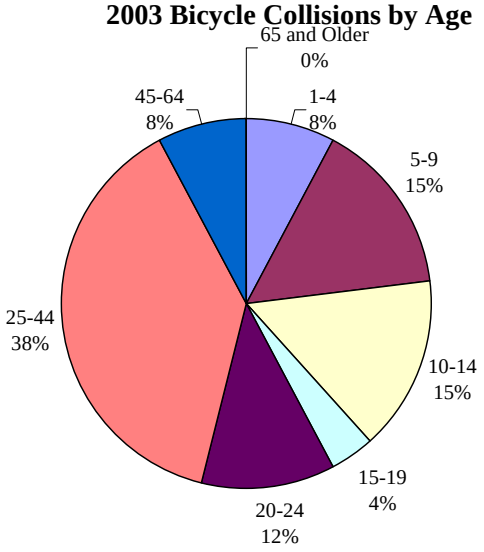
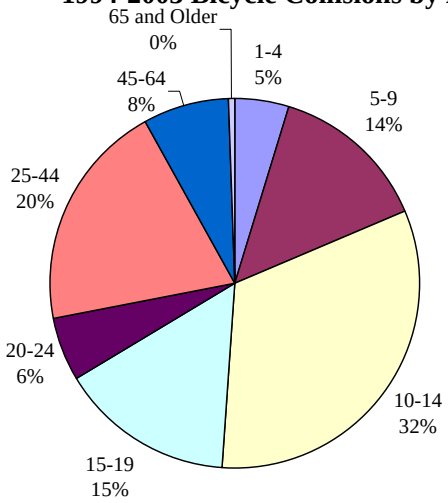


Figure 23
1994-2003 Bicycle Collisions by Age



As indicated in Figure 23, approximately two-thirds of the collisions in the past 10 years involved cyclists under age 20. As with pedestrian collisions, younger cyclist collisions may warrant additional safety efforts.

Table 4 provides a summary of bicycle collisions over the past ten years according to collision type. The collision type was not identified in nearly half of these collisions. Approximately one-half of the remaining collisions involved cyclists crossing or entering traffic.

TABLE 4
BICYCLE COLLISIONS BY COLLISION TYPE
(1994-2003)

Collision Type	Total Number	Percentage
Crossing or Entering Traffic	112	26%
Riding With Traffic	46	11%
Riding Against Traffic	33	8%
Turned into Vehicle Path	31	7%
Fell or pushed into vehicle	3	1%
Unidentified	211	48%
Total	**436**	**100%**

5.10.

Motorcycle Collisions

Motorcycle collisions tend to be severe due to the limited protection provided by motorcycles when compared with passenger cars and other enclosed vehicles. Passage and enforcement of helmet laws are probably the most effective means of reducing the severity of motorcycle collisions. Education may be effective in reducing the frequency of these collisions.

5.10.1. 2003 Collision Experience

Motorcycle collisions comprised 2.3% of the accidents during 2003. A total of 62 collisions occurred, with an estimated cost of $6.4 million. Three fatal accidents occurred, more than any other category except run-off-road collisions.

A breakdown of motorcycle collisions according to severity is shown in Figure 24. As indicated, nearly 90% of the collisions were injury or fatal accidents. As noted in section 4.6, due to the severity of motorcycle collisions and recent increases in the number of collisions, further effort in this area (e.g. education and licensing requirements) may be warranted.

Figure 24
2003 Motorcycle Collisions by Severity